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**MODERN TECHNOLOGY FOR STORAGE AND
RETRIEVAL OF CIVIL REGISTRATION RECORDS AND
PROCESSING OF VITAL STATISTICS**

By

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* The views expressed in this paper are those of the author and do not necessarily reflect those of the United Nations.

MODERN TECHNOLOGY FOR STORAGE AND RETRIEVAL OF CIVIL REGISTRATION RECORDS AND PROCESSING OF VITAL STATISTICS



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INTRODUCTION

The question of advancements in technology and their application to the processes involved in civil registration is one which has been addressed many times in the past decade in the United States. What has been accomplished over this period in the United States reflects the application of technology primarily in the area of vital statistics, and to some degree in one or more components of the civil registration process. There are many reasons for the limited applications in the automation of registration functions. These include 1) the lack of resources to redirect existing manual registration functions to meet new technical requirements; 2) difficulties in obtaining staff, training or equipment in order to apply the technology; 3) limited access in some states to available technology and, 4) restrictions as to appropriate funding and support.

This is not to say technology has not been employed in the civil registration process over the years. Many states in the US have adopted the use of microforms (roll microfilm or microfiche) for the preservation and storage of vital records, and have implemented various types of retrieval systems to access these records. In some cases, computer-assisted microfilm systems (CAM) have been established which allow for the indexing and storage of microfilm records and rapid retrieval. Very early in the application of computers in the registration process, indexes of vital records - births, deaths, marriages - which previously were maintained in printed ledgers or on microforms were computerized and provided an efficient means of identifying and locating individual records regardless of how they were stored. This application was first used in the New York State registration program in the early 1960's. The automated index data elements included the individual's name, date and place of birth, and the given name of the mother. When a request was received for a copy of the birth record, the name was automatically transformed into the Russell Soundex Code (1) to minimize the effect of the misspelling of names in locating an individual's record.

The momentum for registration programs to transition from a paper-based registration system to a paperless system reflect the many functions and responsibilities that civil registration represents. A long paper trail is often produced from the date of occurrence of

the event to the recording of that event in the registration program at the local and state levels. The potential for lost or misplaced records, errors in abstracting and recording of the information, or the lack of reporting of the event are significant factors that must be considered in the operation of the registration program. If legal, operational and administrative procedures are not providing for an effective program, the transition to any type of automated system is unlikely to be successful.

In the United States the need for data and information to conduct monitoring and surveillance of national, state, and local health objectives has become a major issue. The US system, which relies on the reporting of vital events from each state to the national vital statistics office, currently has a lag in reporting of national vital statistics of up to 18 months. At the state level, reporting of events from the local registration offices to the state's central office for vital statistics is more timely, but the subsequent processing requirements - coding, data entry, corrections and amendments - combined with budget and staff reductions also cause significant delays in the preparation of vital statistics in some states. Lag times of up to three years have occurred. These problems have direct impact on the national vital and health statistics program.

To address these issues the national statistical office, the ^{NCHS} National Center for Health Statistics in the US, has established a committee of state and national representatives. This group has recognized that current processing methods in registration must be reconfigured to meet the stated objectives for future needs of vital statistics data and information. The availability of more powerful personal computer technology, expansion of electronic communications nationwide, and the growth in data automation through various software development has resulted in the promotion of automation of registration activities among the fifty states. To accomplish this re-direction of states's programs, three phases for implementation are being considered:

- 1) Restructuring of the states' current civil registration and vital statistics systems over the next decade;
- 2) Development of initiatives to improve current activities and prepare for transition to the new electronic system; and,
- 3) Implement necessary actions to address current problems.

The primary function to restructuring the current registration programs is to change from a batch processing mode to an on-line computer-based system. This system will allow birth and death certificates, and at some later point other vital records, to be created at the reporting source in an electronic form on-line with the statewide system. Activities currently performed at the state

office upon receipt of records - coding, editing, corrections and queries - would be conducted at the reporting source in a standard electronic format. Direct access to the data in this system can then meet the needs of the national vital statistics program and the transfer of non-resident data to the state of residence. This serves both registration and statistical needs of the local, state and national programs.

Initiatives necessary to improve current activities involve the implementation of electronic birth and death certificates through hospitals, nursing facilities, and funeral establishments. This improves the timeliness and quality of the data. There is also the need to move to standard coding and record processing techniques which will allow for the integration of each state's system with the national program and with other states. And, to maintain updated information for both registration and statistical purposes, there is a need to incorporate record modifications as a result of corrections amendments on an interactive basis as they are received into the system. Such changes are to be considered as part of the new electronic system.

The issue to address current problems relates primarily to the lack of resources and diminishing budgets in state programs to support registration and vital statistics functions. In the US, the national statistical program has developed contracts with individual states to provide vital records data for preparing national vital statistics. These contract funds help support individual state programs. Where other problems arise, the national office has provided assistance either in coding or processing activities. These latter items are relatively infrequent however, and the state programs with national endorsements must pursue various means to move into the new technical areas for computerization.

AUTOMATED SYSTEMS

The first phase of the automation process is to have an effective means to administer and operate the program. Given this, whether the existing registration system is paper-based or on microfilm (manual or automated), or if the vital statistics system is computerized and these resources are to be expanded to include registration activities, the type of automated system appropriate to modify the program then becomes a critical decision in developing efficient, timely and responsive registration functions. Considerations for system selection are dependent upon costs, technical capacity, availability of training and related documentation, equipment and maintenance requirements, and appropriate support staff.

At the present time, computerized processing of vital records has been in the area of vital statistics. Each birth, death or marriage record contains basic demographic data as well as medical and

social data relevant to the specific event. For example, standard data are collected on the Certificate of Birth by most of the states in the United States in addition to other data of interest to the specific state. In all of the fifty states, these data are coded and entered into computer-readable format. These are then used in the preparation of vital and health statistics reports, for research and quantitative analysis, and for program direction and evaluation. The data are maintained on magnetic tapes or on disk storage systems and are also provided to the national government for use in preparing national vital statistics. Until recently very little of this processing has been incorporated into the civil registration programs conducted independently by each state.

This focus on the automation of vital statistics programs is changing however. Up to now, the registration activities have been a low priority. As long as a copy of a certificate could be prepared, the system was thought to be adequate. This is no longer the case. Major shifts in the requirements for documentation to receive public service support, increasing mobility of the population, the need for more timely vital statistics, and decreases in program staff due to serious budget deficiencies has led to reconsideration on how to have an effective and low cost registration system. The primary focus is now on reducing costs and at the same time maintaining a responsive program. This has led to a variety of approaches for automation of registration functions and operations.

There are a number of factors to consider when addressing the questions related to the establishment of automated systems for use in the registration process. First and foremost are the characteristics of the current registration program. Record volume, the number of daily transactions such as record corrections and amendments, indexing, security, and data integrity all dictate the direction for establishing an automated system. Currently, automated systems development for civil registration activities include computer-based systems, optical disk systems, and computer-assisted microfilm systems. The system of choice, and the operational program to be the focus of the automation effort, is largely based on the attributes of the existing registration program, areas where support is needed most, and for vital statistics. Each of the above systems provides unique functional capabilities, and requires a complete review and evaluation prior to system selection and implementation in the identified areas.

Technological advances in computer software and hardware, and in other media such as optical disk and microform systems, allow for mass storage and rapid access and retrieval of information. Subsequent processing of transactions against the established database, the preparation of record copies and reports, and the compilation of related statistics have become much more efficient and economical than in existing manual systems. This technology is now more frequently being considered by many states for

implementation in civil registration. The utility and effectiveness of automation in terms of costs, operational productivity and timely system responsiveness are major reasons for re-directing programs to an automated environment.

In developing computer-based systems, a major consideration is data entry. In a registration program which is totally paper-oriented, this can be a significant cost and time factor in getting the system up and operational. It is often necessary to concentrate on selected years representing the highest volume of activity for initial placement into the system, and moving forward in time with current records. This approach gives immediate benefits in reducing workload and processing, while building a fully automated system for the future.

Where previous years of data are already in machine-readable form that is, are contained on magnetic tapes or disks, the movement to a fully operational computer system becomes a more meaningful option. In many states in the US, the original data entry to machine-readable formats was developed for vital statistics purposes only. These files are now being used to prepare automated indexes for record searches, and for the preparation of short-form certifications for births and deaths in place of full registration copies of the records. These files have given a number of states a head start toward more automation of registration activities.

Within a computer based system, record storage and retrieval, indexing, record searches, corrections, and the preparation of record copies for transcripts or certifications are quickly and easily processed, and the security of the data is maximum. Such systems can be developed in a networked personal computer (PC) environment or on a mainframe computer system depending on the volume of records and related processing. PC's now have hundreds of megabytes of disk storage with processors operating at very high speed, and contain networking and communications capabilities. These factors bring computer systems for civil registration activities down to reasonable costs, with relatively small physical environments required for the equipment, and highly "user-friendly" software for operations and training of staff.

An alternative to the computer-based system, particularly as this relates to large existing paper-based systems where data entry would not be feasible, is the use of optical disk. In this type of system, the record is scanned and placed on an optical disk. Several states have moved in this direction in recent years. An electronic index is created at the time of scanning, allowing search and retrieval of records at electronic speed. Optical disk gives an exact replica of the original record as opposed to the computer-based data entry system where only selected data are in the system in digitized form. In addition, storage capacity of a single disk can range up to a million records.

Optical disk provides for massive storage in minimal space; provides for efficient retrieval of records; and, produces exact copies of the original record. New technology is currently underway in this area which allows for corrections and amendments to be made directly to the records on the disk. Most current applications have only the ~~"write-once, read-many"~~ (WORM) disk technology. This is now being modified to accommodate the need for amendments and corrections to the original records. However, the data cannot be directly processed to produce related vital statistics. This is the advantage of the computer-based system in that all of the data in the computer can be processed to prepare reports, statistical summaries, and to conduct research utilizing the computer data base, as well as to complete most of the processes related to civil registration.

Between these two types of systems is the computer-assisted microfilm (CAM) system. This system takes advantage of the fact that many civil registration programs have instituted a microfilm system for record storage, retrieval and copy preparation. This technology has been in existence for many years and has been implemented in many countries. Enhancements have been made by incorporating electronic technology into the system. Existing microfilm, in roll or fiche form, can be integrated into a computer-assisted system which then allows processing to take place at significantly higher speed than the original microfilm processing equipment. Through electronic indexing the microfilm can be searched and records retrieved very quickly. Where microfilm has not been previously used and documents still remain in hardcopy form, the documents can be filmed very quickly and placed into the CAM system.

Processing for statistical purposes and related analytical usage is not practical with microfilm images. Also, corrections and amendments to the record, since it is on film, are not as efficient as in the computer system or optical disk system. Since the system has a microprocessor, search and retrieval of registration documents is at electronic speed. This type of system, as with optical disk, is best suited where the activity is focused on registration functions that is, record storage, retrieval, and copy preparation. Data processing for statistical purposes and for report generation and analytical uses of the data are best accomplished in the computer-based or optical disk systems.

Because of these differences, it is essential that in selecting an automated system or the functions to be automated for civil registration, the total expectations and purposes planned for the records and the data must be fully described. Where record storage and processing is the major goal, optical disk or CAM systems can provide an effective system for operations; where there is need for data processing for statistical, epidemiological, and research purposes in addition to the registration functions the computer-

based system provides the greater flexibility. And, of course, a combination of the two can be implemented to effectively produce a system to meet each aspect of registration and vital statistics.

It is clear that the technology exists to bring civil registration into an automated environment. System costs for software, hardware, equipment maintenance and training have been reduced to levels where these items can be very cost-effective in a registration program. Most states are moving in this direction and, where such systems have been implemented, the resultant cost-savings, timeliness of processing, staff efficiency, and applications development have significantly outweighed the initial investment to become operational. The current national committee is planning to support a nationwide automated system operational by the end of this decade where electronic birth and death records are transmitted from the reporting source directly to the state registration office and, following processing of the records, state vital statistics data will be transferred electronically via modems to the national statistical office.

APPLICATIONS FOR REGISTRATION FUNCTIONS

The application of computer technology to the administrative and operational activities of civil registration has in recent years received major attention in state programs in the United States. In the past, computerization had focused primarily on the vital and health statistics and research components of state vital registration systems, with registration functions continuing in a manual mode. Some developments in automation have occurred over the years, but most of these efforts have been directed to the solution of individual problem areas such as record storage or indexing.

More recently, automation has been extended to encompass all of the operational functions of civil registration with the goal of developing a completely automated registration system. Several states in the United States are very close to realizing this goal, with many states now directing major resources to implement such systems. Over the next five years, most states will have significant portions of their registration activities fully automated, with several approaching a "paperless" system.

Increased demands on the registration system for services and for vital and health statistics data that can be derived from the system has resulted in the states to move toward the automation of registration functions. The directions taken in various states in the US differ in part due to their unique requirements, the present status of the existing system, and to some extent due to availability of staff, equipment, and training. These are limitations to implementing computerized systems, but decreasing costs for computer equipment, and user-friendly software are rapidly making such development feasible and affordable. Specific areas of the registration program in the states being considered as

primary for automation include data entry, record processing, indexing, record storage and retrieval, certification forms, amendment and correction of records, and data transmission.

Data Entry, Storage and Retrieval

Several approaches have been taken in resolving the problems associated with entering data from vital record forms. Traditional processing methods have the forms completed in the field, and submitted to the central registration agency for coding and data entry. This requires substantial resources in terms of staff, equipment and storage space. As these resources become more costly, alternative methods of getting the data into an automated format have to be considered.

One method is to have the coding and data entry occur at the source of the event such as the hospital or clinic. Records can be transmitted electronically over telephone lines or, the data can be copied and submitted to the registration office on floppy disks. This process employs a microcomputer (PC) located at the site which contains a software package to display the certificate form and to perform certain editing functions. Staff enter the information on the displayed form, which then undergoes an editing process on the PC. Edit checks include such items as verifying that data fields contain only appropriate alpha or numeric data; codes for selected variables are in the proper range; and variables such as age, date of event, and residence are accurate.

This approach eliminates the need for a centralized coding and data entry staff, and minimizes the need for interchange of certificates from the official registration office with the hospitals or clinics for corrections or incomplete data. This significantly improves the timing and availability of the data both for registration and vital statistics purposes. Estimates indicate that data entry requirements are reduced from 40% to over 60% at the central agency level, coding is reduced by 50%, and the timeliness and availability of the data is increased by nearly 80%. These percentages reflect differences between manual and automated processing techniques.

Costs of the equipment and the software for this type of application varies depending on the volume of records and size of the population. Inclusion of other types of vital records to the system would require only an additional cost for the software packages for each record type. Additional equipment is not required for these additional records since the disk capacity for PC's can be easily expanded at reasonable cost. Costs for equipment and software would be required for each site from which the data is entered in order to implement remote processing. For many states in the US, the record volumes are small, in many cases less than 100,000 vital events annually. In these areas, personal computers can accommodate most of the processing needs associated both with

registration and vital statistics functions. In the larger states, large mainframe computers are used for conducting similar functions.

A second approach being taken is the use of optical disk systems for record storage, retrieval and issuing copies of records. Certificates completed in the field are forwarded from the local registration office to the central agency for coding, scanning, and indexing for entry into the system. This type of system produces a high quality image that does not suffer from deterioration such as found with paper documents or microfilm. A high resolution scanner is used to electronically capture record images, which are stored on optical disks. A computerized indexing system provides for automatic searching of the documents, with the amount of data entry for the index directly related to the number of variables needed for record identification. Generally these include name and soundex code, date of the event and place of occurrence.

This system can also provide the capability to enter selected statistical data at the time of preparing the index to allow for the development of selected basic vital statistics data along with the processing of routine registration activities. In this way a fast, cost-effective and efficient processing system for meeting registration demands of the population as well as providing a capability for preparing relevant vital statistics can be achieved. The types of statistical variables are limited and relate primarily to demographic information for descriptive purposes only.

Costs associated with optical disk systems vary widely, depending on the size of the system and the applications to be included. The growing use of PC-based optical disk systems makes their use in various applications cost effective. (Optical disk provides an exact copy of the original document and incorporates the full capabilities of a computerized system to locate, link and process the documents. A major savings in data entry staff, time and resources are also realized with this type of system. Such systems, including scanning equipment, computer and processors can range from \$10,000 to \$100,000 depending on the size of the application.

Completely computerized systems for record storage, processing and retrieval in which the certificate data are keyed and stored on disks on mainframe computer systems are also being developed. This approach has a significant data entry cost associated with it, particularly if multiple years of data are to be placed into the system for both registration and statistical purposes. It does however afford the greatest degree of flexibility in terms of total document processing. Copies of the record can be prepared, corrected and mailed electronically; complete indexing parameters are available for record matching and retrieval; updating of data is done without the need to create or modify paper documents; and

information is readily available to multiple users and for multiple uses.

Indexing of Records

A key element in each of the systems described above is the indexing of the stored record. In all cases, automated systems have a computerized index for record search and retrieval, whether the systems are computer-based, optical disk or CAM systems. Information contained in the index generally includes name of the individual, date of the event, residence of the individual, and place of occurrence of the event. Other variables such as sex, race, names of parents may be included. In most instances, the index may contain sufficient information to produce a certification form for use by the public.

Different methods for indexing are used for locating a record, including a straight alphabetical search on the surname and/or given name, use of **Russell Soundex** code(1) (which can be generated automatically by the computer), NYS Identification and Intelligence System code(2) or other algorithms based on the name of the individual. In addition to the alphabetic name or code, the date of the event and place of occurrence are usually all that are needed to locate the record. In an index listing containing over 5 million records, an average search time for a specific record on a PC is under 10 seconds, depending on the size of the computer and the algorithm used. Where indexes contain sufficient data for the preparation of a certification, a certification form can be printed simultaneously.

The savings in time and staff of a computerized index as compared to manual searching using index books or manual microfilm-based indexes are significant. The cost of disk storage has decreased to the point where a computer index on either a mainframe or microcomputer system is a highly cost-effective and efficient method for record searching and retrieval. The algorithm used to encode the name of the individual to whom the record relates must be carefully considered. For example, the Russell soundex code eliminates all vowels contained in a name in arriving at the code to be used in the search. This may not be an effective code for records where multiple vowels are common occurrences in family names.

Electronic Vital Record

The major area of development at the present time in the civil registration area in many states in the United States is the **electronic birth certificate (EBC)**. Births account for the largest volume of records and require the greatest amount of registration activity, thus representing the single most cost-effective record for automation. The amount of information collected on the birth certificate, the number of copies issued annually, the amount of

processing for corrections and updating, and the variety of applications for use of this record far exceed those of all the other types of vital records. It is because of these characteristics that the birth record is the first record to be computerized in many registration programs.

There are a number of advantages to computerizing the birth record. First and foremost is the fact that the birth record is completed at the originating source. This affords a convenient location to place equipment, provide training, and to establish standards for operation of the system. In doing so, immediate benefits are realized with significant reductions in transcription errors, incomplete reporting of data, the need for followback queries, and in lost certificates. Once the data are entered at the hospital, the data are immediately available to the hospital for its own use, as well as in a format for printing and for transmission to the state agency. A printed paper copy, if needed, may be routed through a series of local agencies prior to final storage at the central office. However, since the data are transmitted electronically there is no delay in the availability of the record. Records can be instantly regenerated either at the hospital or at the central registration office without the need to reenter any of the data.

The security afforded by the electronic system is not readily reproducible in a manual system. Information received only via the electronic system are validated as official records. Fraudulent paper copies of certificates cannot be added to the system and can be identified through cross-matching of the paper and electronic documents. Entry of data into the records can be done only by authorized staff through a series of controls on identification and password access to the computer system. Any irregularities in the system related to registration data can be quickly identified as to the staff authorized to have access to the computer. All changes to the record are controlled through the electronic system, and can easily be restricted in terms of what changes can be made and by whom.

The EBC affords a number of processing features which reduce the need for subsequent record corrections or changes. The audit/edit features built into the system include spelling checks, data validation, auto-coding of selected variables such as institution and geographic locality through the use of look-up tables, single entry of common data elements such as dates, and automatic calculation of variables such as length of gestation (based on the dates of delivery and last menses) or conversions (eg. pounds and ounces to grams). Each of these features saves significant processing time, reduces the need for subsequent changes to the record, and minimizes many types of errors.

The computerized system provides the flexibility for local access to computer-based birth records. Communication networks can be

established whereby an authorized local or regional registration office can access the central computer, initiate a search for a record and have the information transmitted and printed on a birth certification form in the local office. This is a growing area of development, the decentralized access and retrieval of records for registration purposes.

The transmission of data to the state central registration office from the hospital for the EBC takes one of several forms. The data, when entered on the microcomputer at the hospital, may be copied to a diskette and mailed to the office. The diskettes are then uploaded to the agency's mainframe or microprocessor which contains the birth registration database. Generally this is the first option used when initiating remote preparation of the record. A second method is to process birth records at the hospital and prepare a database for subsequent transmission electronically over telephone lines. This approach has been implemented in a number of registration programs primarily in hospitals which have a large volume of births.

The EBC being implemented in the United States is a computer software product which will result in the standardization of both the recording and reporting of data for birth events. The primary objectives include:

- * Uniform recording and reporting of birth events based on standard data collection procedures, editing, coding and filing methods.
- * Establishment of a core birth record which can incorporate prenatal information by importing the data from other computerized data bases; exporting relevant data to other programs or operational functions; and, expansion of the utilization of the birth information for other applications.
- * Flexibility in record and data modifications, for linkage to other computerized systems, and for record matching.
- * Systemic linking of related maternal and newborn data information for medical and health monitoring and quality of care evaluation.
- * Improve timeliness, data quality and accessibility to the birth information.
- * Provide automated processing functions to minimize data entry, reduce multiple recording and abstracting of selected information, incorporate editing features, and to access data dictionary or reference tables for coding and verification purposes.

- * Increase use of birth database information for tracking and matching records with related health and medical data sets, determining patterns of delivery, and integration with other facility information resources.

The electronic birth record, where it has been implemented, has minimized the need for manual intervention in the processing of the record, and has provided significant improvements in 1) the quality of the data as received from the source, 2) the timeliness of receipt of the data, 3) efficiency in processing changes and corrections, 4) maintaining security and confidentiality since fewer staff are necessary to handle the records, 5) availability of the data for multiple use and users, 6) electronic search and retrieval of documents and, 7) minimal physical storage requirements and handling of the documents.

Several states which have implemented the EBC are now moving toward development of the electronic death certificate (EDC) as well. This is the ultimate goal for the national committee, to have both certificates in electronic form in each state in the US by the close of the decade. The EDC is a more difficult record to place in the electronic format from the reporting perspective. In the US, essentially all live births occur in hospitals, thus giving a single, common source for the completion of an electronic birth record. For deaths, approximately half occur in hospitals and the remainder in other types of facilities and at home. There are a large number of funeral establishments, making the reporting source difficult to address.

The initial efforts being taken at this time in some states is to focus on the deaths occurring in hospitals as the initial implementation source for the EDC. Following this, large facilities and funeral establishments will be incorporated into the electronic system. The percentage of total events reached at this level will then determine to what degree additional reporting sources will be added to the system.

As part of this development for the EDC, the NCHS is developing a software system that will allow the direct computer entry of literal statements for cause of death. The software will then translate the literal statement into cause of death codes, as well as the code for the underlying cause. The software will also edit the reporting of the medical certification items on the death certificate, and will immediately indicate to the certifier if an improper term or sequence of cause events is being entered into the system. The EDC is expected to have a significant impact on the quality of the mortality data and timeliness of reporting of the events. Here the goal is to have fifty percent of the death events reported through the electronic network by the end of the decade. This means that a number of states will have to incorporate the EDC in the next several years, and be prepared to transfer the data electronically to the national vital statistics program. This

latter activity is now being conducted by several states with birth data and does not represent a major problem at his time.

OTHER REGISTRATION APPLICATIONS

A number of automated registration functions with regard to the electronic record which have been developed include transaction processing, billing and accounting features, and direct mailing of both registration materials and information related to maternal and child health. These are labor-intensive activities which lend themselves very readily to computer processing. The electronic transfer of the records from the reporting sources makes for timely processing of the events, and for providing services to the public. Examples of the types of activities which have been automated include:

1. **Key Entry** - data entry into machine-readable format makes the following items more timely and efficient, with minimum staffing requirements:

- * Edits records (replaces former manual edits).
- * Writes letters asking corrections for errors (replaces manual system).
- * Codes entries automatically (replaces manual coding system).
- * Allows on-line update for corrections and amendments (replaces manual coding and batch entry).
- * Allows entry of indexes for historical records.

2. **Correspondence** - automated record and letter forms eliminate need for typing and storage of hardcopy documents.

- * Allows entry of administrative information for all requests for documents (replaces 5-part paper receipt form).
- * Allows tracking requests in response to inquiries from the public or from law enforcement.

3. **Fee Tracking and Accounting** - provides an automated accounting software package to be used for audits, review and calculations.

- * Accounts for all fees received (replaces paper documents needed for audit purposes; partial replacement for manual deposit requirements).

4. **Issuance of Certified Copies** - establishes a standard process for record copy and modifications, with access limited through authorizations to computer files; improves security and confidentiality of the record information.

- * Allows immediate search and issuance of birth certificates (replaces manual search and photocopy of record).
- * Allows legal amendments to birth records (replaces 2-part paper certified copies).

5. **Production of Administrative Reports** - allows for standard reports and updates in a timely manner.

- * Indexes for use by central and local registration offices.
- * Fiscal reports for budget, deposits, special accounts.
- * Administrative workload reports for registration section.
- * Reports on field offices.
- * ~~Notification of registration of parents.~~

6. **"New" Record System** - provides immediate access to the original record for ~~legal changes or replacement~~, and for the creation of "new" records where required.

- * Preparation of accurate information following adoption or paternity action (replaces manual correction process).
- * Update database with "new" information (expedites updating of record data base).
- * ~~Cross-reference information, new/old name, for tracking impounded records for the registrant (newly available process).~~
- * Notification of changes to local offices.

Each of the above automated functional registration areas has significantly changed and improved the operation of the registration program in many of the states in the US. Within this context, it should be noted that these benefits go beyond those associated solely with the registration functions. Software packages such as word processors, data base management systems, and spreadsheets can be incorporated into the microcomputers used for the registration system to further enhance processing and productivity. Examples include correspondence to consumers prepared using a word processor; a series of workload statistics compiled from a spreadsheet; and, integration of data from other administrative records with information contained in a database management system.

SUMMARY

The development, application and implementation of automated registration programs have in recent years moved at an accelerated pace in the United States. Impetus for the change can be found in the increased demands of the population for registration services, declining staff resources due to budget cuts, and technological advances which make automation a feasible option. The directions being taken vary and include systems utilizing computers, optical

disk and computer-assisted microfilm. Each approach is designed to meet specific needs of the particular registration program.

The direction a particular state registration program has taken is often based on the developments which have been made in other registration programs. Where computerization has occurred, computer programs and systems which have been developed have been made available to other registration programs which are considering implementation of automated systems. It is clear that there is a need for automation as record volumes grow, demands for services increase, and resources and funds decline which are necessary to provide services. Registration activities have not drawn the funding or resources as compared to other programs. This is changing, however, and much of the new efforts are being directed to upgrading programs through the use of automation.

Costs to initiate a computerized system for registration vary widely. Many programs have taken a stepwise approach, automating current registration functions or selected activities and incorporating older records and related processing functions at a later time. This reduces the need for major expenditures for data entry or scanning and indexing of records, computer equipment and software, training and redeployment of staff. For registration programs having low volumes of records most of the processes described above can be accommodated on microcomputers.

Other options which permit gradual movement to an automated registration system include microfilm systems utilizing computer-assisted retrieval and optical disk systems. These systems also offer computerized indexing capabilities for record search and retrieval. One of the difficulties associated with these systems is in error correction and updating. Changes to microfilm are difficult, usually requiring the creation of a separate record copy and subsequent storage and indexing of the new record. Current optical disk systems are also in this category, where most have "write once, read many" disk formats, though erasable media are now becoming available. This means that where separate images must be made for corrected or updated records on WORM disks, items can now be erased and corrections inserted onto the optical disk. The flexibility of the electronic record is clearly superior in this regard. Compared to manual systems, however, both microfilm and optical disk systems offer major advantages.

The question of the capability to transfer components of automated systems from one registration program to another is one area which needs to be explored in more detail. As programs move toward the development of automated registration systems there is a clear benefit to have available the information of what has occurred. Not only are mistakes and problems minimized, but the potential use of software and the processes and procedures which have led to successful operational systems can significantly reduce costs,

efforts and time in other programs. The impact of automation on civil registration programs in general will produce positive results, and in the longer term provide a basis for standardization of civil registration programs at the national level in decentralized systems such as in the United States, providing immediate interchange of information for registration purposes, vital and health statistics, technical assistance and support.

The capability to share information electronically among states on a national level can be a significant improvement in the monitoring of vital events for state residents. To develop resident vital statistics at the state level, it is important to know of those events for residents which occurred in other states. Currently in the United States, there is a memorandum of agreement among the states which provides the transfer of vital records occurring in each of the other states to the states in which the individual is of official residence. The complexity of this arrangement, which for some states could result in certificate copies being transmitted to the other forty-nine states on a monthly basis, has caused some difficulties. Through an electronic system where all states are linked to the national program, such record transfers become routine.

There is no doubt that in a decentralized system, where each state is responsible for civil registration but share the data with the national office for use in the preparation of national vital statistics and with the other states for obtaining resident vital events, the transition to an electronic system is an effective option. Within each state, the benefits have also been clearly identified. The development of an electronic birth and death record can produce significant benefits for both registration and vital statistics activities.

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